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The Use of Ethyl Chloride
as a General Anaesthetic
for Children.



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It is with very great pleasure that I submit to the Faculty of Medicine of the University of Edinburgh a few pages on "The Use of anaesthetic Ethyl Chloride as a general^Afor Children" as my Thesis for the Degree of Doctor of Medicine.

My experience in the use of ethyl chloride as a general anaesthetic was gained while I held the appointment of Anaesthetist to the Outpatient Department of the Royal Edinburgh Hospital for Sick Children - a post I held for nearly two years. Further, as a Supervisor of Anaesthetics in the Royal Infirmary Edinburgh, and as Anaesthetist while acting in the Royal Army Medical Corps, I was able to add to my experience in the giving of anaesthetics, but it is with regard to children that I wish to draw attention to the application and scope of ethyl chloride as a general anaesthetic.

At the Royal Edinburgh Hospital for Sick Children in the Outpatient Department alone, 1400 anaesthetic cases passed through my hands in the year. So in nearly two years I was enabled to draw some conclusions as to the usefulness of such an anaesthetic as ethyl chloride. The age limit in the hospital is twelve years, so my work as anaesthetist there, was

chiefly for childrens' complaints. A great number of Tonsil and Adenoid operations and the operation of Circumcision passed through my hands for anaesthetising, and surely these operations link together the great sciences of Medicine and Surgery and prove how necessary for the removal of otherwise medical complaints an operation becomes.

To encourage the laity to see the importance of such operations as these, and to assist the surgeon in giving him good results and also in preserving the life of the young community, a suitable and safe anaesthetic is all important. It is a fact that the laity are far more afraid of the anaesthetic which is being administered to the child than of the operation, hence the practitioner should use as safe an anaesthetic as possible.

Chloroform was my chief mainstay when first I started giving anaesthetics at the Sick Childrens' Hospital, but very soon, owing to disastrous results, I experimented with a view to finding for each operation a more suitable and safe anaesthetic. Regarding the various methods I shall give a full description later.

For cooperation in my work my warmest thanks

are due to Mr Stiles and Mr Fraser, respectively Surgeon and Assistant Surgeon to the Royal Edinburgh Hospital for Sick Children, and to my friend, the late Dr Mc Allum, the chief anaesthetist at the hospital in my time.

The following are my observations regarding the application and scope of ethyl chloride as a general anaesthetic for children.

The practice of the various methods of using this form of anaesthesia has been mainly carried out, and observations made, in the Outpatient Department of the Royal Edinburgh Hospital for Sick Children.

The use of ethyl chloride as a general anaesthetic is so recent that it has not, so far gained for itself much favour among the profession, especially the English school. Yet we can say, judging from our experience of its use, that we have in ethyl chloride our safest and most useful anaesthetic for short operations on children.

This anaesthetic is used alone for short operations lasting two minutes or less, and is used in sequence with Chloroform Ether mixture for those

occupying a longer time.

Three methods of administering Ethyl Chloride have been adopted.

1. The semi-open method used as a routine for opening abscesses.
2. The closed method used as a routine for the removal of tonsils and adenoids.
3. In sequence with chloroform ether mixture used as a routine for circumcision.

The Semi-open Method:-

This method, or a modification of it, is referred to by many writers on anaesthetics but has not been adopted as a routine.

It is indicated as a suitable anaesthetic for children of ages, varying from several weeks to three years, particularly for such minor operations as the following:- opening abscesses, curetting adenoids, removing finger nails or toe nails, scraping ulcers, extracting teeth, etc.

It is an advantage that the child should have no food for three hours before administration.

The following apparatus is required:-

1. A Schimmelbusch's mask covered with four ply bandage cotton which may be had at Turnbull and Wilsons', Edinburgh.
2. A soft towel folded and of a size sufficient to cover the mask and to leave a broad overlapping edge all round.
3. A tube of Ethyl Chloride (Duncan Flockhart) fitted with a spraying nozzle.
4. A tube glass phial, measuring cubic centimetres.

The technique of the administration is as follows- Any preparation of the part to be operated on must be completed before the administration is commenced and the gag inserted when necessary.

The dose of ethyl chloride is measured into the glass phial, which is held in the right hand, and the contents rapidly sprinkled over the under surface of the mask, which is held in the left hand, and to the outside of which the towel has previously been applied.

The face is immediately covered with the mask and towel, the air-way being limited by the overlapping edge of the latter.

The usual dose required is four cubic centimetres for a child of two years.

A child crying at the commencement of the administration very quickly becomes quiet, the breathing becoming regular and deep and a soft snore indicates sufficient anaesthesia for the surgeon to commence.

During the induction attend closely to the breathing, allowing a little air, should there be any holding of the breath,

The average induction period in my recorded cases, was forty seconds, and the duration of anaesthesia, one and a half to two minutes with the original dose, by simply keeping the mask applied where possible.

The surgeon was enabled, in a case of glandular abscess, to incise the skin, open up with sinus forceps, scrape cavity with sharp spoon, and pack with gauze without the child coming out.

A still longer anaesthesia, sufficient to enable the surgeon to perform circumcision, has been successful by spraying on the mask more anaesthetic from time to time.

Recovery is rapid, the child being at first dazed and then excited, much depending how it went under.

No dangerous symptoms have arisen in my cases, and so long as one pays attention to the breathing

and colour, little danger attends this method of administration. It has not once been necessary to perform artificial respiration.

The ages of children anaesthetised by this method ranged from ten weeks to three years.

The after effects were practically nil, even in one circumcision case which I observed afterwards outside the hospital. There is usually no vomiting unless blood has been swallowed during the operation.

The children were able to leave hospital in the course of two hours.

2. The Closed Method:-

The closed method of administering ethyl chloride is the usual one, for short operations lasting two minutes or less. It is by preference a single dose anaesthesia and its best results are gained thus.

The essential of the method is the breathing in and out of a bag which is charged from the upper or lower end with the drug ethyl chloride.

Having experimented with the various methods mentioned by writers on anaesthetics, I have come to the conclusion that the modification detailed below

has the great advantage of supplying the drug in a gradually increasing strength of vapour.

This method is indicated for the operation of removal of tonsils and adenoids in children of three years and upwards, and one may safely say it is the best routine for such an operation. Its use may be extended for the performance of the other operations mentioned under the semi-open method, especially in children over three years.

In the administration of ethyl chloride by the closed method the preparation of the child must be attended to. The printed directions given the parents at the Royal Edinburgh Hospital for Sick Children may with advantage be detailed.

1. Give a dose of castor oil on the afternoon of the day before the operation.
2. Do not give the child anything to eat or drink on the morning of operation.
3. Bring with you a clean towel and a clean muffler to wrap round the child's mouth when being taken home.
4. The child is to be brought to the Surgical Out-patient Department not later than 8.45 a.m. on the morning of operation.

On the same form equally instructive and useful directions are given regarding the after care of the child- but these need not be detailed.

Of great importance in the successful administration of ethyl chloride for tonsils and adenoids is a suitable gag. The various gags recommended I have tried; but Doyen's gag has given the best results.

With the ordinary instrument sold as Doyens the danger of including the lip gave me trouble and with a slight modification of my own I have overcome this drawback. I am indebted to Messrs Young and Son, Forrest Road, Edinburgh, for the carrying out the design for the above mentioned modification. This relates chiefly to the mouth piece of the gag, the biting part being now placed nearer the tip of the mouth piece, and the limb leading down to it being more slanted so as to give more space for the lip. The biting surface is covered with lead and need not have rubber guards. See Diagram, No. 1.

The following apparatus is required:-

1. An inhaler made up of a rubber bag, of good rubber and of one gallon capacity; medium sized face piece; a metal angle junction tube for the two; a metal tube fitted with a tap and passing down the vertical arm

of the angle junction tube and allowing the passage of the vapour of the ethyl chloride into the bag only. See Diagram, No, 2. A glass phial, graduated in cubic centimetres, having a slight neck and attached by means of a tube three feet long, and half inch bore, to the tap tube just mentioned.

2. A tube of ethyl chloride, sixty centimetres, fitted with a spraying nozzle.

3. A glass beaker filled with water just hot enough for the finger to bear, placed on a stool to the right of the operating table.

During the preparation of the patient the apparatus is got ready and the tap closed. The gag, as described, is inserted on the left side of the mouth and the child asked to bite it, special care being taken that the upper lip is free.

The technique of the administration is as follows-

The necessary dose of ethyl chloride is measured into the phial which is then connected with the inhaler by means of the long rubber tube. The face piece is now placed over the face, the child being instructed to blow out the bag, or the face piece can be manipulated so as to catch enough expired air to

fill the bag. Open the tap and place the phial in the beaker with the right hand, the left hand holding the face piece firmly on the child's face. The ethyl chloride in the phial bubbles away and the vapour gradually passes along the tube into the bag.

The child goes quietly under by this method with rarely any struggle. The breathing deepens, and in less than a minute a soft snoring respiration is indicative of sufficient anaesthesia. Three or four snoring respirations are allowed before the apparatus is laid aside and the gag opened, making sure that the lip is free.

As to dosage, two cc for a child of three years and three c.c. for those of five and over. For a child of three, one c.c. has been successful.

The duration of anaesthesia on the average was one and a half minutes in my recorded cases. The surgeon was enabled both to remove the tonsils and curette the adenoids carefully and successfully.

Recovery is rapid. It was our custom immediately on the completion of the operation to set the child bolt upright and sponge the face with cold water. After a dazed period the child comes round

and is noisy or otherwise, but is soon himself again.

The dangers are few, provided one attends to the breathing, and there is no obstruction. All the children in the outpatient department are stripped and brought into the operating theatre in a blanket.

So far I have not required to perform artificial respiration in a single case.

As to after effects, vomiting, apart from the swallowing of blood, is rare. No case of collapse has come my way. The morning operation and the preparation beforehand appear to give one good results.

3. Ethyl Chloride in sequence with Chloroform Ether mixture.

Barton has used this sequence successfully to induce anaesthesia in patients of ages varying from four months to seventy three years.

Against using pure chloroform for circumcision operations, and requiring a quicker induction than chloroform ether mixture gives alone, I tried this sequence with very good results indeed.

It is used as a routine anaesthetic for the operation of circumcision and has been successful in a child of six weeks old. The method has been

extended with equal results to all other operations on children.

For the administration, the child has to be prepared as before, and is best anaesthetised on the operating table.

The apparatus required is made up of the following:- mask covered with bandage cotton, towel, tube of ethyl chloride and phial, as in the semi-open method, previously described, and in addition a small drop bottle containing equal parts of chloroform and ether freshly mixed. I am indebted to the late Dr Mc Allum Edinburgh, for the instruction he gave me in the use of this mixture.

The technique of the administration is as follows- There are three stages:-

1. The C.E. mixture is dropped on to the outside of the mask which is applied to the face, the head being turned to the left side. In one minute the child usually becomes quiet, and the eyes become drowsy; but if the child is still noisy, proceed to the second stage.
2. This is the semi-open method of administering ethyl chloride already described, using four c.c. of the drug.

3. The child passes quietly into surgical anaesthesia, the breathing becoming regular and deep, the corneal reflex almost abolished. At this stage remove the towel, and drop the C.E. mixture as required on to the outside of the mask, so as just to preserve the corneal reflex. The operator is at liberty to ~~ee~~ commence the operation in two minutes from the beginning of the induction.

The first stage uses a drachm of mixture and the second stage four c.c. of ethyl chloride, for a child of three years.

Of very great importance in children is the ~~corneal~~ corneal reflex, which must never be lost entirely, as its presence means safety, provided the breathing and colour are good.

Recovery is very satisfactory, the child usually enjoying a sleep after the operation

No dangerous symptoms have come under my notice and again I mention that I never lose the corneal reflex in children; and it is found that this may be just present and the surgeon still have sufficient anaesthesia to perform any operation, the muscular relaxation and breathing being perfect.

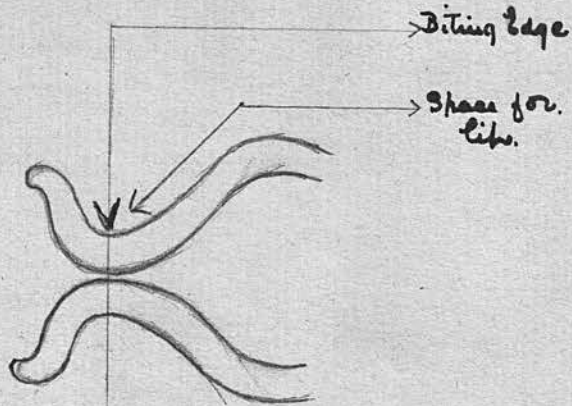
The following conclusions have been arrived at-

1. That Ethyl Chloride is the safest and most useful anaesthetic for short operations on children.
2. That the semi-open method is the best routine anaesthetic for opening abscesses.
3. That the closed method is the best routine anaesthetic for the operation of tonsils and adenoids.
4. That the sequence with C.E. mixture is the best routine for the operation of circumcision.

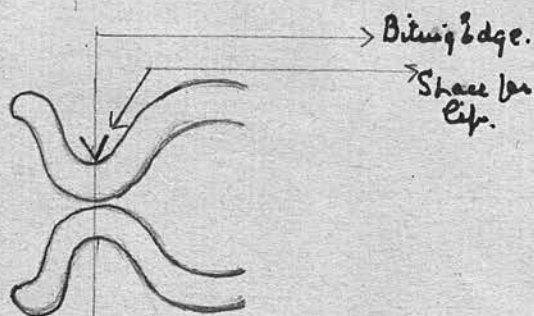
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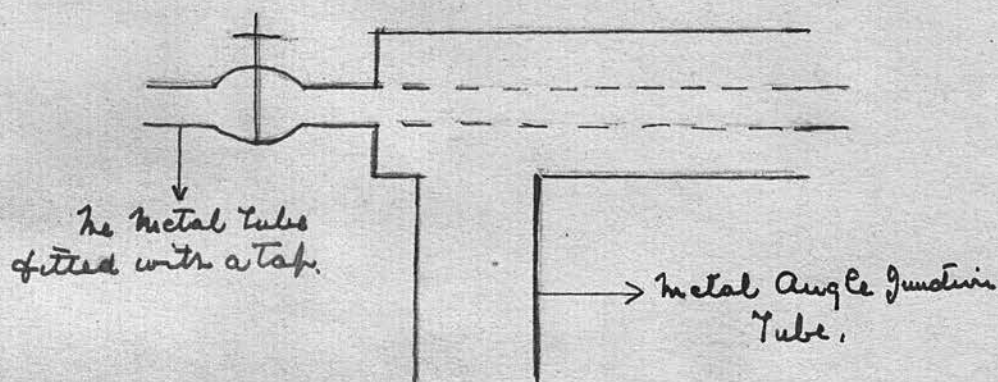
Modification of Doyen's
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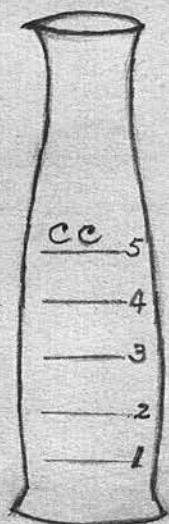


2.



3.

Glass Vial.
measuring cubic
centimetres.



Books and Articles referred to

Anaesthetics and their Administration- Hewitt.

Guide to Anaesthetics- Luke.

Anaesthetics- Blumfield.

Anaesthetics- Boyle.

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A Guide to the Administration of Ethyl Chloride- Barton

Open Ethyl Chloride Anaesthesia- Hornabrook.
